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ABSTRACT

This paper describes some salient aspects of inservice education that focus on constructivist learning/conceptual change. Major issues for inservice education based on the constructivist approach are described. These issues arise from viewing teachers as constructivist learners, and from the assumption that constructivism and conceptual change need to be considered in the same way for both teachers and students. The following assumptions are contained in the constructivist theory of learning: (1) inservice education that matters involves conceptual change on the part of teachers; (2) when the thrust of the inservice program is towards constructivist perspectives on teaching and student learning, the change involves teachers' conceptions of learning and teaching; (3) conceptual change in teachers is most helpfully considered in terms of whether or not new ideas are intelligible, plausible, fruitful, and feasible; (4) the conceptions held by teachers on entering an inservice program will sometimes include ideas and beliefs about the focus of the program which are in conflict with the ideas and beliefs of those running the program; (5) the inservice must, wherever possible, model but not mimic the strategies and ideas being advanced; (6) different groups will enter inservice programs with different levels of relevant knowledge and experience; and (7) those conducting the inservice program must be sensitive to their own needs to undergo conceptual change. Descriptions of four inservice programs illustrate how one or more of these issues arose and was dealt with in the course of the program. (JD)

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Inservice education: Some constructivist perspectives and examples

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In-service education: Some constructivist perspectives

Introduction

The purpose of this paper is to describe some salient aspects of in-service education which focus on constructivist learning/conceptual change. This we do for four selected programs with which we have been involved in recent years. In three of them at least one of us has been an initiator.

The four programs have been chosen in order to illustrate major issues for in-service education (better termed professional development of teachers). These issues, which we describe below before considering the four program examples, arise from constructivist views of learning and conceptual change - where teachers are the learners. That is, the issues of major importance to us arise from considering teachers as constructivist learners and from considering the learning we plan to foster in an inservice program. We have previously argued (Gunstone & Northfield, 1986) that constructivism and conceptual change need to be considered in the same way for students, teachers (and researchers). That theme runs through the issues we now elaborate.

(i) In-service education which matters involves conceptual change on the part of teachers

Our logic here is that in-service which involves no conceptual change at all is, in essence, the sharing of information. In this rare and extreme case, the essential issue is motivation to attend (cognitively as well as physically). In phrasing this assertion in this way we are implying a range of magnitudes of conceptual change. We illustrate this point with two extreme examples.

Our example of a requirement for very substantial conceptual change involves undergraduate teaching in the science faculty of Monash University. We have used undergraduate science students in a number of studies of learning over a number of years. In this process we have generated substantial data about student conception, lack of conceptual change and effects of these on student performance. Similar data has been obtained about other learning issues, e.g. problem solving. Strong inferences about curriculum, teaching, learning and assessment have been drawn from these data. Discussions with science faculty staff, both through formal colloquia and informal talks, have produced very little change. The major factor in our failure here is clearly that the substantial majority of science faculty staff have not accepted the conceptions of learning, teaching, assessment which underpin our research. Their conceptions of learning, teaching, assessment have not changed; hence our findings have no value to them. The lack of change is also a function of the magnitude of change which would be required. This situation will remain until we are able to promote the very substantial conceptual change which is involved in abandoning, for example, the view that the learning of significance for tertiary students is the reproduction of arguments from lecture notes and the solution of very standard forms of problems.

The conceptual change needed to embrace ideas can then be so great as to be apparently unachievable. At the other extreme the change can be of such small magnitude as to be accepted almost immediately. Examples of this are common for the participants in Program 2 described below. The science teachers in this program all have substantial commitment to the value of considering learning, teaching, assessment in constructivist terms. When one of them raises an alternative approach to, say, assessment, or an alternative use of a strategy already familiar to the group, then commonly the process of conceptual change involved in accommodating the new idea takes a matter of minutes. This process of course is fostered by the questioning and discussion of those attempting to accommodate the new idea.

The second example, we hope, indicates the breadth of behaviours we are including under the rubric of conceptual change. The importance of this assertion is in the implications it has for our conceptualization of nature and form of in-service education.

(ii) When the thrust of the in-service program is towards constructivist perspectives on teaching and student learning, the change described in Assertion (i) involves teachers' conceptions of learning and teaching

The extreme example of requirement of great conceptual change given above illustrates this assertion well. The example is extreme only in the extent of dissonance between the conceptions of learning and teaching of some science staff and the researchers. Frequently the negative reactions of teachers to constructivist perspectives on student learning are rooted in the teachers holding conceptions of what should be valued in teaching and learning which are at odds with what is valued in a constructivist view. For example, a rejection of constructivist perspectives on the grounds that this approach to teaching and learning 'takes too much time' is sometimes a euphemism for a model of learning which holds that 'because I say it, therefore they are learning it'.

The significant issue in this assertion is the need to explicitly consider, challenge, and justify the conceptions of teaching and learning of all members of an in-service group. This comes first in most cases.

(iii) Conceptual change in teachers is most helpfully considered in terms of whether or not new ideas are intelligible, plausible, fruitful AND feasible

The application of the ideas of intelligible plausible, fruitful to the consideration of student conceptual change (Hewson, 1981; Posner et al., 1982) is now quite widespread. That these ideas also have great utility in considerations of teacher conceptual change is not a novel thought. In particular, the achievement of fruitfulness with teachers (having them see that new conceptions offer them more than the conceptions they hold) seems a clearly necessary aspect of any change in practice.

As we have noted previously (Gunstone & Northfield, 1986), consideration of teacher change is also enlightened by the addition of the concept of feasibility. When teachers consider the ideas raised in an in-service program, they do so in the context of all other professional and personal demands on them. To embrace the ideas of the in-service, teachers must give greater priority to these ideas than to others which are part of their lives. This we call feasibility, and argue that this behaviour is quite proper.

While fruitfulness is often difficult to achieve, feasibility is even harder to grapple with. In essence, each participant in an in-service program must resolve this issue themselves because the context of each individual will determine the difficulties which feasibility raises. What is important in the in-service is to be open and explicit about these issues.

One other aspect of this assertion deserves greater recognition than it has thusfar received. We have previously alluded (Gunstone & Northfield, 1986) to the important communalities between 'intelligible, plausible, fruitful, feasible' and the substantive literature about educational innovation and change (see, for example, Fullan, 1982). This communality between the change perspectives derived from two fields of research with very different beginning points is in itself a powerful argument for the value of both sets of perspectives.

(iv) <u>The conceptions held by teachers on entering an inservice program will sometimes include ideas and beliefs about the focus of the program which are in conflict with the ideas and beliefs of those running the program</u>

In other words there are occasions when teachers come to an in-service program with an understanding of particular strategies or ideas which are to be raised in the program, but the understanding is different to that held by those running the program. Failure to bring such dissonance into the open has the most obvious consequences.

This assertion does not imply a negative view of such occurrences. Rather it is a recognition of the idiosyncratic construction of meaning, and the judgment that some constructions are less helpful than others. It also reflects another way of describing plausibility and fruitfulness: it is not enough for an individual to understand the reasons underlying another's ideas; seeing the reasons as reasonable is also needed for the individual to begin to accept that idea. We describe a recent experience by way of example.

There has been in Victoria substantial development in uses of concept maps in learning and assessment in science (Gunstone, Mitchell, et al., 1988) and in teacher education. This strategy is commonly included in inservice programs concerned with constructivist learning. At one such ongoing program, focussing on year 12 learning, assessment and curriculum in a city outside Victoria, concept maps were introduced. One of the participants was initially quite disinterested. He is a highly motivated, perceptive and involved teacher (for some years an office bearer in the Australian Science Teachers' Association). Several years before this inservice he had listened to a lecture on concept maps, and formed negative opinions about the strategy. The particular event in the inservice which brought out and challenged this view is highly predictable - he did a concept map himself for the first time.

This leads directly to our next assertion.

(v) <u>The inservice must, wherever possible, model but not mimic the strategies and ideas being advanced</u>

It is important to use in the teaching of the program the perspectives which the inservice program aims to develop. Sometimes the perspective can be used directly to teach about the perspective; for example, the most powerful way to introduce the notion of interpretative discussions (Barnes, 1976) is by running an interpretative discussion about, say, what discussions can achieve in science classrooms. In other cases it is not possible to be so direct. For example, it is a very complex process to use concept maps to

teach about concept maps. In such cases, it is vital to have participants undertake appropriate other examples of the strategy/perspective in question. In the case of concept maps, this means having participants do concept mapping tasks which are of a cognitive demand which is likely to lead to the participants learning something new about the content on which the mapping task focusses. This is different to doing a mapping task which might be directly given to the students the participants teach. Hence our assertion states that the inservice should model but not mimic.

There are a number of reasons for advancing this assertion. Foremost is that showing that the strategy/perspective can be fruitful in terms of the learning of the participant is a major step towards having the participant see the strategy/perspective as fruitful for their teaching. Experiencing the role of learner for the idea increases the understanding of the potential of the idea and of ways of taking or adapting the idea into one's own classes. At a more tenuous, but most important, level, there is the value of credibility. In the positive sense, those teaching in the inservice program are showing a commitment to the value of the ideas they are advancing by using the ideas directly in their teaching; and they should not be reluctant to point this out. It is the absence of such credibility which usually attracts negative teacher reaction, and this is not at all surprising. Consider the implicit messages given by one who lectures on the value of discussion, or one who argues that individuals construct their own meanings 'but I'm telling you precisely what this means'.

(vi) <u>Different groups will enter inservice programs with different levels of relevant knowledge and experience</u>

This assertion is self-evident. It is one important contribution to some of the differences between some of the four examples of programs given below. It is included here because of its relevance to consideration of an idea central to this symposium: directedness.

We conceive directedness as 'who sets and who presents the agenda?' for the inservice. Further, we believe it is necessary to consider two broad levels of directedness: who sets the agenda for the broad focus of the inservice and who determines the approach to the inservice. One of our examples below illustrates this clearly. In Program 2, the focus of the program is explicitly and consistently on student ideas and conceptual change as powerful views to promote learning with understanding. Beyond that, the agenda of the program is totally in the hands of the group.

The notion of an inservice being totally directed by those running the program seems clearly unreasonable. As implied by Assertion (v) above, the need for consistency between principle and practice requires that an inservice focussing on constructivist views recognizes that teachers will come to the program with expectations of and ideas about what the program can offer. This leads to our next assertion which, given these statements, needs little further elaboration.

(vii) Those conducting the inservice program must be sensitive to their own needs to undergo conceptual change

For this assertion we point out that our experiences with practising teachers over the last decade have been the major contribution to our changing understanding of ideas of teaching and learning. In some cases these experiences have been directly responsible for our forming new ideas of fundamental significance to our research.

Issues arising from pre-service constructivist programs

There are other issues of significance arising from our pre-service program, a program with a strong constructivist philosophy. For us this pre-service experience is, of course, more systematic and more concentrated and we thus have much stronger data to assist in forming issues to guide us.

There are three issues in particular which are of substantial significance to our pre-service program, and which we believe have similar significance to inservice programs. However we have less inservice data to support these than is the case for the preceding assertions.

The first of these is that teachers need colleagues to help construct their ideas; it is a daunting (and often impossible) task to construct new ideas alone. This implies not only others with whom to test ideas during the inservice but also the possibility of doing this outside the inservice. Ideally this would be colleague(s) in the same school, otherwise our only strategy is to establish ongoing networks to promote the interaction.

Secondly, the colleagues with whom a teacher interacts in this way must be people in whom the teacher has confidence. The generation of confidence in all other group members (including those running the program!) is an important task for an inservice.

The third issue is a corollary to Assertion (v) but, at least at the pre-service level, a most important issue. For many teachers the perspectives argued in a pre-service or inservice program which focusses on constructivism and conceptual change are seen to involve high risk. For example, an adoption of constructivist perspectives can be seen as a loss of control, a reduction in the power of the teacher to maintain the direction of lessons. Encouraging teachers to take these risks is difficult. At the pre-service level data shows clearly that a major factor in students deciding to take such perceived risks is the observation that those teaching the pre-service course are also prepared to take such risks. In the negative sense then we are again pointing to the harm done by arguing 'do as I say, not as I do'. We believe this particular issue is also important in inservice, but does not have as much supporting data.

Other issues

Some important issues are not mentioned above. One is of such major influence that we do state it here: conceptual change takes time, for teachers as well as students. The structure of inservice programs must recognize this.

There is one other issue which we believe must be considered in constructivist-oriented inservice, but which is only tangential to the focus of this symposium. It is an issue which should be addressed in such inservice: the conceptions of students about teaching and learning. The nature of some of these conceptions and the ways they influence student learning are summarized in Gunstone (in press), and many examples are given in Baird and Mitchell (1986). It is clear that what students see as appropriate teaching and learning (in science and in other subjects) is often at odds with the teaching and learning valued by a constructivist perspective. This issue must be tackled by the teacher for there to be any chance of students seeing fruitfulness in a constructivist/conceptual change approach. For teachers to tackle the issue they themselves must have an understanding of the nature and importance of children's views of learning and teaching; hence the need to include this perspective in inservice programs.

The context of the inservice programs

Before turning to the four examples of programs, a few relevant aspects of the educational context in which they occur are mentioned in order to assist with interpreting the descriptions.

Education in the state of Victoria is far less textbook oriented than is the case in the United States. Teachers frequently do not have a single, prescribed text (although the current trend is towards greater use of textbooks). Where classes have textbooks it is again not uncommon for teachers to make very little use of them. There is a greater likelihood than in the US of teachers developing their own units of work for a topic or short sequence of lessons. There is then a much greater tradition of teacher-generated materials for single lessons or whole topics, and somewhat less concern with having prepared materials to guide the direction of instruction.

This is enhanced by the fact that, for the last 20 years, individual schools have had the responsibility for deciding what science (for example) to teach in years 7-10 (and even whether or not to teach science).

Finally, very few inservice programs in Australia carry any form of credit towards any qualification or promotion. This is certainly so for all four examples now described.

Four examples of inservice programs

Three of the four examples we have chosen are different in both form and target audience from structures typical of inservice programs. The example which might be seen as more conventional is described first.

Program 1

This type of program is illustrated via reference to a 1984 inservice. That inservice was advertised in a circular sent to schools on the mailing list of the Monash Teachers Centre (a centre located in the Education Faculty at Monash University). The program was titled 'Relating Teaching to Learning' and its stated purposes included long term involvement linking ideas with teaching practice, teachers following up ideas and providing input for the sessions (with the program having flexibility to incorporate teacher priorities and interests), ideas and teaching approaches to be adapted and used by teachers to gather information from their classrooms, and using colleagues to gain an understanding of teaching and learning processes. Consistent with some of these purposes, at least two participants from any one school were requested (but not required). The organization of the program also reflected the purposes: the program involved meeting after school (4.30-6.30 pm) once every two weeks for five meetings. The period between meetings was intended for reflection and the trying out of ideas. The description of the program also suggested that it was aimed at those with little knowledge and experience in the area of constructivist learning (a term not used in the description).

A total of 17 teachers arrived at the first session: 14 from high schools (with three from each of two schools, two from each of two schools, four singles); two from separate primary schools and one secondary school

curriculum writer. After welcomes, introductions and a brief discussion of the view of learning underlying the inservice, participants wrote both an outline of any previous contact with this view of learning and the science topics for which they were particularly interested in considering the implications of this view of learning. Two aspects of these responses illustrate some of the issues we have raised earlier in this paper. Twelve teachers indicated no previous contact, and five had heard a lecture by Roger Osborne at the 1983 conference of the Science Teachers Association of Victoria. Of these five, three had also read at least one article about children's ideas in science and one of these was also a Masters student in our faculty. There was then great diversity in the extent of knowledge and experience in the area. One primary teacher responded to the request for topics of interest as follows: 'I need to learn about magnetism and electricity in particular'. Her needs were substantialy different to our purposes, a dissonance which she coped with by just not coming after the first session.

We planned the program so that successive sessions became more open, but we had a clear agenda for the first session. Throughout the inservice we did not hesitate to draw on our own experiences of teaching a year 7 science class during 1984 (Northfield & Gunstone, 1985).

In the first session we discussed the general phenomenon of children's ideas, and considered techniques for identifying these. Because of the way in which the session evolved, we offered copies of some working papers from the New Zealand Learning in Science Project to participants. These were topic based working papers which gave details of both methods used to probe student ideas about a topic (such as 'plants', 'force', 'physical change', etc) and data about the ideas found. Osborne and Freyberg (1985) give details of the Learning in Science Project. Those who wished took any one (or more) working papers with the intent of using the methods given in the paper to

probe the ideas of their own students. The second session began by discussing the experiences of these teachers.

Subsequent sessions discussed teaching strategies and eventually moved to considering ways of promoting student understanding and control of their own learning. This was part of our initial agenda.

Program 2

In November 1985 we contacted by letter 16 Melbourne secondary school science teachers whom we knew were attempting to respond in some form to research on students' ideas in science. In the letter the purposes of this meeting were described as follows: 'to allow all of you to share your perspectives and experiences; to explore whether or not there are ways in which we can support one another in using children's ideas in teaching; to see if there is value in meeting again'. We were aware of the interests and activities of the 16 teachers from a variety of sources - two were involved in Program 1 above and had continued to explore ideas, some we had contacted in other inservice programs, some were current or former Masters students who had focussed on classroom implications of constructivism, some were involved in Program 3 below, and one was a product of our 1984 pre-service program.

At this first meeting, 14 of the 16 invited teachers arrived, together with four others who had heard of the meeting through one of the 16 invitees. Also present were seven Monash faculty members with interest in the interplay of research and practice in the learning of science, and Gaalen Erickson, who was visiting Monash from the University of British Colombia. At this first meeting we began with the teachers describing aspects of what they were doing and what concerns they had. The academics were deliberately very quiet (a characteristic which has tended to remain as the group has continued to meet). The academics were also most impressed; all of us found it an extraordinarily stimulating meeting. We are sure it was most helpful to the confidence of the group that Gaalen Erickson was able to offer the opinion that it would be hard

to find anywhere else in the world such a range of teacher initiated work on students' ideas in science.

That the group should meet again was never debated. All the teachers were anxious for this to happen. The group's agenda, as debated and determined at the first meeting, has been essentially unchanged. This has been to share ideas and support in four broad areas: ways of productively using what we know of students' ideas; forms of assessing which can contribute to learning and which are consistent with the purposes we share for teaching from constructivist perspectives; ideas and materials for implementing these ideas; ways of trying to convince colleagues of the legitimacy of teaching from these perspectives. (The last of these was particularly important to those who were alone on the staff of their school in terms of these ways of considering teaching and learning.)

This agenda was determined with little or no input from the academics, and this pattern of teacher determination of direction has remained a strong feature as the group has flourished. The group met a second time in 1985, nine times in 1986, and nine times in 1987. (This is about once a month during the school year.) The group has grown as others have become involved, with, at the end of 1987, 12 of the original 18 still committed and an additional 16 science teachers participating. Not everyone is able to attend every meeting, but these numbers represent those with quite regular contact.

In Victoria, the area of students' ideas and beliefs is known as Children's Science. This is an unfortunate term as it implies a restriction of these ideas/beliefs to children and to the content area of science - both unreasonable implications (Gunstone, in press). However it is the term in common usage among teachers, hence this group has become known as the Monash Children's Science Group.

The group has generated a wide variety of ideas, and fostered major professional development among its members. It now receives requests to

conduct inservices, requests which are met only via the conducting of the inservice by practising school teacher group members. The group has also attempted to spread its ideas by writing for the local science teachers' journal, and more widely (Gunstone, Mitchell & The Monash Children's Science Group, 1988). Currently a booklet of teaching and learning ideas is in preparation.

The academics in the group have consistently viewed the group as a meeting of equals, some of whom have professional knowledge and some of whom have more contextually isolated and more formalized research knowledge. The academics have undergone considerable conceptual change. This view of equality of sources of knowledge has been a major factor in the remarkable development of the group, and in the extent of learning among the academics.

The organizational support we give the group is, we believe, also very important. This includes letters before each meeting with reminders of date of meeting and the specific agenda, as previously decided. More importantly the support involves undertaking the coordination of ideas for inservices the group conducts and coordinating the written material the group produces.

Program 3

This we describe only briefly, as an extensive account of this program already exists (Baird & Mitchell, 1986). This is a single school program involving teachers from a number of subject areas. The explicit purpose of the program is to develop in students an understanding and control of their own learning. In the process of working towards this goal the teachers involved have themselves been through an extensive, but informal, inservice program.

This program was initiated at the beginning of the 1985 school year, in a Melbourne high school, by a member of the school's staff. The staff member had completed a Masters degree at Monash University in which he explored classroom implications of children's ideas. He was then moved to consider

the extension of this work into metacognitive areas by attendance at the conference of the Australian Science Education Research Association. He recruited about ten volunteers from the staff of his school for this program, as well as the active involvement and participation of a number of academics, one of whom spent a day per week in the school, the others attending as they were able.

The inservice dimension of this enterprise was, as for Program 2, essentially in the hands of the teachers. Academics who were present reacted, but only initiated consideration of particular issues when asked to do so. The school staff involved have had regular meetings throught the program, and these have formed the basis of the extensive inservice. A wide variety of issues have been raised at the meetings and reflected on during classroom teaching. These range through teaching strategies such as concept maps, alternative approaches to assessment, other strategies for increasing the fruitfulness to students of metacognitive perspectives.

Accounts of the first year of the program have been given by the teachers and academics involved, and by one year 10 student (Baird & Mitchell, 1986). A second book based on the 1986 experiences is in preparation. Hence we give no further detail here.

The reasons for including this program in our examples is that it represents our view of a most powerful mode of inservice education. An informed and committed change agent was present within the school, and was part of the school. The change agent was able to use considerable resources from outside the school, and, together with the other teachers, to maintain control of these resources.

As for participants in Program 2, the teachers (and, in one case, the students) involved have themselves become personnel who conduct further inservice programs.

Program 4

This is an attempt to extend the general structure of Program 3 into a more usual school environment. The origins of this program are in the developments of our views of appropriate research strategies for understanding the teaching and learning of science (Gunstone, White, & Fensham, 1988).

In the middle of 1987 we approached two schools to invite the science staff to become involved in the same general form of collaborative research which has so characterized Program 3. These schools were chosen solely on the grounds of geographic convenience for a research fellow involved in the research. While our initiating agenda is research, the style of the research is very much collaborative with teachers (rather than on teachers) and of the general mode argued by Bolster(1985). The program illustrates the symbiotic relationship we see between helpful forms of school-based research and professional development of teachers.

Our research agenda in this case is, simplistically, to understand the development of expertise in science teachers and to explore the interactions of this development with student learning. This research will spread over three years. Here we comment briefly on some professional development aspects of our intrusion into one of the two schools.

Our approach to both shools involved getting cooperation from the school administration, and then discussing with the science staff our purposes and our views about collaborative research involving teachers and researchers. Five volunteers came forward in the school we now consider.

The teachers and researchers have met regularly and undertaken a number of activities. These include (i) the individual interviewing of all teachers about their perception of learning, teaching, and some science concepts; (ii) reflection-on-practice over a short series of lessons, with the teacher being interviewed beforehand about what was planned for the lessons and why

this was planned, a researcher observing the lessons and discussing observations with the teacher, the collection of student perceptions of the purpose, nature and success of the lessons; (iii) the gradual evolution of agreement among the five teachers of an issue on which they wished to focus their investigations. This issue is the decline in student interest in science as students move through the school - whether such decline is as strong as the general staff perception suggests, what factors contribute to such decline, what consequent action is possible and desirable. By December 1987 (the end of the school year) the teachers had formalized their perceptions of factors contributing to any decline in interest, and had collected survey data about the existence of any decline and student opinion relevant to the decline. Early in 1988 they appear to be moving towards some of the constructivist/conceptual change/metacognitive issues which we would see as important in this context.

Throughout this process, the role of the researchers has been very much reactive and supportive in nature. There has been consistent and deliberate restraint from telling teachers, from directing their thinking. The again major professional development among the teachers arises from our approach.

Some concluding comments

The communality shared by these four program examples is an attempt to adhere to the assertions and issues we have laid out in the earlier section of the paper. In particular, all represent what Schon describes as the reflective practicum, particularly in the sense that the 'reflective practicum must be a hall of mirrors because the teacher of the teacher is also doing the thing that she is teaching' (Schon, 1987). This ideological consistency we argue is crucial to the acceptance by teachers of fruitfulness for them in the issue being raised.

The diversity of contexts, organizational structure and audiences in our four examples leads to a questioning of the utility of 'directedness' as a

variable in inservice programs. We have made it clear that we see directedness in the teaching approach used in an inservice as appropriate only when such methodology is consistent with the purposes of the inservice and the needs of the participants. For example, those teachers in Program 2 do ask colleagues in the group (teachers or researchers) to describe and explain techniques and ideas about which they want to know. Even in these cases it is important for the description and explanation to be structured in ways that allow exploration of fruitfulness by participants. Directedness in planning the inservice, as opposed to directedness in teaching it, seems even less helpful. In one sense, Program 3 has been highly directed - the change agent in the school has had an unwavering commitment to the broad focus of enhancing student metacognition; on the other hand the path towards this focus has been in the hands of the participants.

Program 4 certainly had a highly directed initiation. The two schools involved had no internal change agent of the form present in Program 3. In fact we had no prior knowledge of any science teacher in either school being at all aware of our perspectives on learning and teaching. Had we not approached the schools and deliberately set about selling the value of what we wanted to do, there would be no Program 4. However directedness, in terms of our imposing our agenda, finished when the schools decided to be involved. Throughout the subsequent life of this on-going program almost all the teachers have shown continuing enthusiasm, major involvement (occasionally, and inevitably, mediated by feasibility), considerable time commitment, and earnest desire to grapple with issues whose understanding they believe will lead to improved professional practice. This strong teacher acceptance derives from their role in setting the agenda for the program.

Rather than directedness, we believe our assertions about and examples of inservice programs point to the crucial importance of adopting structures for inservice which allow for greater recognition of the need for participants to

be involved in setting the agenda, which enhance rather than detract from the quality of the inservice, which seriously accept that change is difficult and personal and time consuming, and which accept the existence of important and substantial professional knowledge amongst teachers. If this leads to directedness at some level, so be it.

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